Electron phonon coupling in 2D materials from nano-ARPES

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Angle resolved photoemission is a true many-body spectroscopy and has played a key-role in establishing the phenomenology of cuprate superconductors and other strongly correlated electron systems. However, its application to 2D materials is still at an early stage and has thus far been largely limited to mapping of the overall band structure.
Here, I will present two examples of recent ARPES experiments in which we resolve distinct signatures of electron phonon coupling. Our data on monolayers of the common semiconductors 2H-WSe_2 and WS_2 on hBN show two replica bands of the Γ valley at energies matching hBN phonon modes. This provides strong evidence for long range interfacial electron-phonon coupling which we attribute to the polar nature of hBN.
We further study the superconducting semimetal T_d-$MoTe_2$, which attracted attention because of an unusual enhancement of the critical temperature as the thickness is reduced to a monolayer. Our laser micro-ARPES data on monolayer T_d-$MoTe_2$ show a complex spectral function with multiple energy scales and renormalized quasiparticles characteristic of strong coupling to several phonon modes. The strength and thickness dependence of electron phonon coupling revealed in our data is consistent with the enhancement of superconductivity in the monolayer limit.